

What is claimed is:

- 1 1. A method for mapping surface topography of a substrate comprising:
2 forming a non-metallic film over a substrate;
3 forming a metal film over said non-metallic film;
4 polishing to remove at least a portion of said metal film; and
5 distinguishing first regions in which said metal film remains, from second regions
6 in which said metal film has been removed and said non-metallic film is exposed.
- 1 2. The method as in claim 1, wherein said forming a non-metallic film over a
2 substrate comprises forming a dielectric film over a semiconductor substrate.
- 1 3. The method as in claim 1, wherein said substrate includes at least one
2 further film formed thereover, and said forming a non-metallic film comprises forming a
3 dielectric film over said at least one further film.
- 1 4. The method as in claim 3, wherein said at least one further film includes a
2 patterned polysilicon film and a polished interlevel dielectric film formed thereover.
- 1 5. The method as in claim 3, wherein said polishing and said distinguishing
2 take place during in-line processing of semiconductor devices being formed on said
3 substrate and further comprising generating topographical data of a surface of said
4 substrate.
- 1 6. The method as in claim 1, wherein said forming a metal film comprises
2 forming a copper film.
- 1 7. The method as in claim 1, wherein said polishing comprises chemical
2 mechanical polishing (CMP).
- 1 8. The method as in claim 1, wherein said distinguishing includes using an
2 interferometer to monitor optical signals directed to a top surface of said substrate.

1 9. The method as in claim 1, wherein said distinguishing is repeated
2 periodically during said polishing.

1 10. The method as in claim 1, wherein said distinguishing is repeated
2 substantially continuously during said polishing.

1 11. The method as in claim 10, wherein said distinguishing includes spatially
2 distinguishing said first regions from said second regions a plurality of times during said
3 polishing, and further comprising generating a three-dimensional topographical map of
4 said substrate based on said distinguishing.

1 12. The method as in claim 1, wherein said distinguishing includes directing
2 an optical signal to a top surface of said substrate and using an interferometer to detect
3 one of a return refracted signal and a return reflected signal.

1 13. The method as in claim 12, wherein said directing an optical signal
2 includes causing said optical signal to scan across said top surface.

1 14. The method as in claim 1, further comprising generating a map of
2 substrate topography based on data obtained during said distinguishing.

1 15. The method as claim 14, further comprising instituting in-line process
2 controls based on said map.

1 16. The method as in claim 14, wherein said first regions correspond to
2 relatively depressed regions of said substrate and said second regions correspond to
3 relatively raised regions of said substrate.

1 17. The method as in claim 1, wherein said substrate is generally round and
2 includes a diameter of about 12 inches and said distinguishing includes monitoring
3 optical signals directed to a plurality of locations, each of said plurality of locations
4 separated from other of said plurality of locations by about 10-20 mm.

1 18. The method as in claim 1, wherein said substrate comprises a
2 semiconductor substrate upon which a plurality of semiconductor devices are being

3 formed, and said distinguishing includes monitoring optical signals directed to a plurality
4 of scribe lines between respective semiconductor devices of said plurality of
5 semiconductor devices on said semiconductor substrate.

1 19. A method for mapping surface topography of a substrate comprising:

2 forming a non-reflective film over a substrate;

3 forming a reflective film over said non-reflective film;

4 polishing to remove at least a portion of said reflective film; and

5 distinguishing first regions in which said reflective film remains, from second
6 regions in which said reflective film has been removed and said non-reflective film is
7 exposed.

1 20. An apparatus for in-line monitoring of surface topography of a substrate
2 comprising:

3 a body for receiving a substrate thereon;

4 polishing means for polishing a surface of said substrate; and

5 detecting means for detecting a presence or absence of a reflective film at a
6 plurality of locations on said surface during said polishing operation.
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1 21. The apparatus as in claim 20, wherein said detecting means comprise an
2 optical system.
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1 22. The apparatus as in claim 20, wherein said detecting means comprise an
2 interferometer.
3

1 23. The apparatus as in claim 20, wherein said polishing means comprise a
2 chemical mechanical polishing apparatus.
3

1 24. The apparatus as in claim 20, wherein said detecting means detects a
2 presence or absence of said reflective film at a plurality of locations on said surface,
3 several times during a polishing operation.
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1 25. The apparatus as in claim 20, further comprising display means that
2 provide an output indicative of topography of said substrate.
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1 26. The apparatus as in claim 25, in which said display means is coupled to
2 electronic circuitry that compares said output to pass/fail criteria.